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An Evaluation of the Asphalt Dispersion Units Effects at the Mead Corporation's Otsego Paperboard Mill

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AN EVALUATION OF THE ASPHALT DISPERSION UNITS EFFECTS AT THE MEAD CORPORATION'S OTSEGO PAPERBOARD MILL

by

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ABSTRACT

An evaluation is presented as to the process effects of the asphalt dispersion unit at the Mead Corporation's Otsego Paperboard Mill. The parameters investigated were: steam consumption, refining load, production rate, temperature of process, machine cleanliness and sheet properties such as appearance, caliper, moisture, stiffness, and mullen plybonds. The procedures used are presented and the results are included as daily averages in tables and graphs. The asphalt dispersion units effects were determined by comparison of data taken when the unit was operating as opposed to when the unit was shutdown and by passed.

It was found that there was a substantial decrease in steam usage. The production rate and refining were not adversely affected as was expected. The sheet appearance was poor when the A.D. was off and the caliper and moisture relationships were inconclusive. The board was also stiffer and had a higher ply bond strength when the A.D. is off. It was recommended that this mill can, with the grades manufactured, operate without the asphalt dispersion unit.

The complicating factor was that the A.D. unit uses only turbine exhaust steam which must be generated regardless.

TABLE OF CONTENTS

INTRODUCTION

It has been proposed that the Mead Corporation's, Otsego Mill could realize a substantial energy savings by the discontinuation of the use of the Asphalt Dispersion Unit (A.D.). There are, however, several possible side effects to this action whose impact must be evaluated before the actual relative value of this step can be determined.

Of course, the appearance of the sheet will not be nearly as good with the Asphalt Dispersion Unit not operating; but with the particular grades manufactured at Otsego, it is hoped the customers reaction will not be excessively negative.

A more important consequence of this action would be a possible loss in production. The A.D. Unit adds a great deal of heat to the rawstock which is believed to increase drainage rate. Any loss in production would have to be weighed against energy savings in dollar values.

The total heat change throughout the system should be investigated to determine the heat effect of the A.D. Unit on all phases of the Otsego operation.

The refining load would be expected to increase due to the greater stiffness and hardness of the cooler fibers in the nondispersed rawstock.

The Asphalt Unit is also believed to help keep down the number and severity of felt, cylinder wire, dryer can, and press roll deposits. The value of this theory will need to be tested.

Sheet properties other than appearance are likely to be affected by the heat and agitation present in the A.D. Unit. Perhaps sheet profiles, such as moisture and caliper, and certainly strength properties, such as mullen plybond and stiffness, will vary from when the A.D. Unit is operating.

The final parameter, and perhaps the only positive factor to result from this action, is the reduction in steam consumption. The amount of steam needed to operate the Asphalt Unit is believed to be a large fraction of the total usage in the mill. This will be the major offsetting factor to some of the more detrimental effects.

The aforementioned factors serve as the basis and justification for the experimentation and evaluations to follow.

A HISTORY OF ASPHALT DISPERSION

Asphalt and other thermoplastics have been used in the manufacture of many types of paper and paperboard since before the turn of the century. These additives are used for their barrier characteristics and as adhesives. Their presence did not cause any problems until World War II when the recycling of waste paper became necessary. When these asphalt treated papers were recycled, for use mainly in paperboard and corrugating medium, the asphalt appeared as unsightly black spots in the sheet. This was not merely a problem in esthetics however, because the asphalt would form deposits that could plug wires, fill felts, and stick to all equipment it came into contact with. Also, if the sheet was to be printed or coated the asphalt would pick out, or not accept the coating or ink. So the presence of the petroleum based additives, in the form of large spots as they were appearing, was undesirable and troublesome.

The first major attempt to deal with this problem was made in 1947 when eighteen paperboard manufacturing companies formed a cooperative effort known as the Jute Group which later became the Fiber Conservation Corporation. This group donated money to the Institute of Paper Chemistry (I.P.C.) to research the problem of asphalt and thermoplastics in waste paper used for rawstock.

The I. P. C. process was based on the concept of dispersing the asphalt and plastics into particles so small that they would be undiscernable to the naked eye. This must be done at a high solids level, 30-40% solids, with enough water remaining to allow the asphalt to flow and be spread out onto the individual fibers. Steam pressure of 50-60 psi is required with a temperature of 300^{o}F. At these temperatures and pressures the asphalt and plastics become fluid and any volatile components are vaporized.

The mechanics of the system are relatively simple. After the stock is defibered and cleaned, it is fed to standard deckers. The stock is discharged from the deckers at 10% consistency into a dewatering press which discharges at 35% solids. A screw feeder then supplies a continuous digester where the steam is added and the stock is retained for three to four minutes. The cooked stock then passes, under pressure, to a disk refiner which discharges to atmosphere through a cyclone. On the units operating with this principle in 1960, steam consumption was from 1,500 to 3,000 pounds per ton of stock. The I. P. C. process is used at Mead's Otsego Mill. The operation at Otsego will be explained in greater detail later.

The next innovation in the search to eliminate noticeable asphalt was to use higher pressures (80 psi) in the digester and remove the disk refiner. The stock was then discharged through motorized discharge valves to a cyclone tank.

All the literature cited claims that the Asphalt Dispersion Units improve sheet formation as well as visual characteristics. They also claim that the strength properties of the finished sheet are unaffected.

The only other attempts to deal with asphalt were with solvents and absorptive materials. The solvents in the past have been expensive and extremely volatile. So, the combination of price and fire hazard made the solvents impractical for most mills. There are solvents in use today but the tonnage they treat represents a very small fraction of the total tonnage of waste paper used. Absorptive materials such as diatomaceous earth and clay have met with only limited success and are not is use at this time.

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ASPHALT DISPERSION AT MEAD'S OTSEGO MILL

As was mentioned, the process developed at the Institute of Paper Chemistry is used at Otsego. This mill manufactures high caliper paperboard. There are no white grades and most board is laminated. The major end uses are for puzzle, game and book cover board with other uses being automotive board and construction grades. The Asphalt Unit is only used on the filler stock, with any liner or partial liner coming from cleaner rawstock. Approximately 230 tons/day are made with almost all of the rawstock passing through the A.D. Unit.

The mechanics of this system are nearly identical to the I.P.C. process with only slight equipment variations. The raw waste paper is defibered in a hydrapulper with ragger and junk remover. The stock then passes through centrifugal cleaners and to a side hill screen. Then much of the water is removed on cylinder deckers and Davenport dewatering presses to give 30-35% consistency which is necessary for adequate dispersion. Next a screw feeder feeds the digester where the steam is added at 60 psi and the temperature is 250-300^{o}F. The stock is discharged through a disk refiner to dilution and storage.

This unit has been operating at Otsego for many years but there is no operating data on steam and power consumption or effects on the cylinder machine process. As was discussed in the introduction, the objectives of this research will be to generate this data and evaluate its effect.

EXPERIMENTAL PROCEDURE

The grade mix was limited to the oak and chestnut grades exclusively which greatly simplified comparisons.

To evaluate the refining load, only the Bauer Single Disk refiner and the Majestic Jordon were included, as they are the most often used. The amperes drawn by each refiner plus the plate pressure was recorded several times daily and then averaged to give a daily average ampere loading.

Production was determined in average pounds per day for each day. This will be determined from calculations using machine speed, trim width, and basis weight as follows:

$$\frac{\text{Trim}}{12} \times \text{Speed} \times 60 \times \frac{\text{Basis Wt.}}{1{,}000} = \text{Production in pounds per hour}$$

To determine the overall temperature effect on the system, readings were taken at the filler hydrapulper, the sidehill screen, on the discharge end of the A.D. Unit, and in machine vats two (2), five (5), and eight (8).

Machine cleanliness was evaluated by inspection and from the "feel" of the operators.

The finished board machine sheet was tested for these profile characteristics: caliper in increments of six inches, and moisture by cutting eight samples per trim width. Average density per day of the standard grades and the mullen plybond strength, broken down by calipers, were determined. The appearance was judged by comparison.

Finally the steam usage readings were recorded from daily chart averages in pounds per hour from the No. 4 Boiler. Also, the dryer back pressure and condensate return to the boiler were recorded.

To form the comparisons, data was taken on days of steady state operation for four weeks with the A.D. Unit operating, then for eight weeks with the unit shut down, and finally, for an additional three weeks with the unit reactivated.

RESULTS

Refining

It was found that the power drawn by the refiners to reach the desired freeness averaged slightly less with the asphalt unit not operating. The Bauer single disk refiner averaged 60 amperes when the asphalt unit was operating as opposed to 55 amperes when it was not operating. The plate pressure ran 17% lower which contributed to the reduced ampere loading. The Majestic Jordan showed this same trend but at the higher difference of 10 amperes (Figure 1, Table I).

Production

The average production was slightly higher without the asphalt unit. This difference was small, however, and well within the scope of daily fluctuation so it is doubtful that there is a relation to the asphalt unit (Figure 2, Table II).

Temperature

As the stock left the asphalt unit, it was nearly 30 degrees Fahrenheit hotter than when the A.D. was not used, but by the time the stock flowed into the vats, it had been cooled to within 20 degrees of the average temperature without the unit. The difference was only 10 degrees in Number 8 Vat, which carries partial liner stock, which is not A.D. stock. The filler hydrapulper and sidehill screen temperatures were unaffected by the unit (Figure 3, Table III).

Machine Cleanliness

The duration of this study did not allow for indepth comparison of felt or wire life, but a few examples of increased dirt levels did appear. All the wet end presses acquired a grey sticking accumulation at the doctor blades that appeared to be petroleum based products. There was a slight increase in slime appearances and occasional bothersome dryer deposits. None of these problems were, however, of any serious magnitude.

Sheet Properties

The appearance of the sheet, which was probably the most effected property, was quite poor in contrast to a sheet from A.D. stock. When the A.D. was not in operation, the dirt level varied from extremely high to a level comparable to A.D. stock depending on the raw waste paper quality.

As data was collected on caliper and moisture profiles, it became apparent that these two characteristics would not be easily related to the asphalt dispersion unit.

Strength properties were changed slightly. The board became stiffer when the A.D. was not used and the mullen plybonds increased (Table IV). These properties also relate to the higher density which was the most detrimental effect of the discontinuation (Table V, Figure 4). Average densities ~~for Densities~~ for December, 1975; September, 1976; October 1976; and November, 1976 by caliper are included for reference. (Figure 5)

Steam Usage

The amount of steam needed to run the operation was reduced by approximately 10,000 lbs/hr which was the main objective of the asphalt unit shutdown (Figure 6, Table VI). The dryer back pressure and condensate return showed practically no change (Table VII, Figure 7).

DISCUSSION OF RESULTS

Refining

The refining load necessary to achieve the desired freeness was expected to increase due to the greater stiffness of the cooler fibers when the asphalt unit was not in operation. This problem did not materialize, and in fact the refining load was slightly less. This was a peculiar development and one that appears to have no theoretical explanation.

Production

With a substantial heat loss in the stock, there would be expected a loss in production of the dryer limited machine, due to the slower drainage of the cooler stock. There was only a small change in the production however, and that change was an increase. This difference is so small that it falls well within the scope of daily fluctuations, so it is doubtful that there is any direct relation to the asphalt unit.

Temperature

The overall temperature change due to the asphalt unit was minimal. Since the temperature effects on refining and production were not as detrimental as expected this parameter has little operational importance.

Machine Cleanliness

As was stated in the "results", the effect on the dirt level was not evaluated over a long enough period of time to definitely dismiss this as a possibly serious side effect. Over the period of this study, there were no evidences of major operational problems due to an increase of petroleum products deposits.

Sheet Properties

The appearance of the sheet was quite bad when the asphalt unit was by-passed, but not so unsightly as to increase the number of customer complaints over the norm.

The conclusion about the effect on caliper and moisture profiles was that too many other factors have a much greater effect on these properties. Such a great effect, in fact, as to make any correlation to the asphalt unit inconclusive.

The strength properties of stiffness and mullen plybond increased due to the fact that the individual fibers retain more strength when not heated to the temperatures of the dispersion process. The density was adversely affected based on the price structure used to sell the board. A more dense board of the same caliper uses more fiber at the same selling price as the less dense board. Heating the stock in the dispersion unit gives it a greater fluffiness.

Steam Usage

The main objective of this study was to determine if the steam saving caused by shutting down the asphalt dispersion unit was great enought to offset the negative factors resulting from this action. The foreseeable factors were indeed sufficiently offset, but a hidden factor had a greater overall economic effect than any of the investigated parameters.

This factor was that the asphalt dispersion unit uses only turbine exhaust steam. This steam can be used to manufacture electricity at a much lower cost than buying it from Consumers Power Company, so the steam should be generated even if it is not ultimately used for the dispersion process and at this time there is no other use for it.

CONCLUSIONS AND RECOMMENDATIONS

It was concluded that the Mead Corporation's Otsego Paperboard Mill could indeed operate without the use of the asphalt dispersion unit. The grades manufactured do not require a high degree of cleanliness, so money spent on removing dirt is wasted. The concerns about production losses and refining energy increases were also unwarranted. The steam saving was as great as expected but the need to buy electricity if the steam was not generated was not anticipated.

It is recommended that an investigation into the energy savings from steam generation for electricity manufacture be assigned. This would give a better estimation in dollar amounts for comparison. It is also recommended that if the steam must be generated for electricity, the exhaust should be used for the dispersion of asphalt. But if there develops another use for this steam or if maintenance of the asphalt dispersion unit or its associated equipment becomes a burden, then the unit should be shutdown and bypassed. Also, if the cost of steam generation for electricity approaches the cost of purchases electricity, the dispersion unit use should be discontinued. Finally, an investigation should be conducted into the financial aspects of producing a more dense sheet, which contains more raw fiber, which is then sold by the point of caliper.

TABLES AND FIGURES

TABLE I

Refining Load

DATE	REFINER	AMPS	PLATE PRESS
1-5	B	72	63
1-6	2J	90,68	
1-7	B	65	66
1-10	B	44	50
1-11	B	71	68
1-12	B	52	48
1-13	B	48	46
1-14	B	49	50
1-17	B	75	48
1-18	B	64	51
1-2	M	52	--
1-21	M	40	--
1-24	M	45	--
1-25	M&J	44-90	--
1-26	M	56	--
1-27	M	45	--
1-28	M	47	--
2-1	M	38	--
2-2	B	45	52
2-4	B	34	60
2-8	M	50	--
2-10	M	54	--
2-11	M	56	--
3-13	M	60	--
3-14	B	70	68
3-15	B	74	74
3-16	M	50	--
3-19	M	60	--
3-20	M	62	--
3-21	M	60	--
3-22	B	60	64
3-23	B	60	64
3-27	B	32	60

	AMPS	P.P.
Bauer = B	60	64 A.D. ON
	55	53 A.D. OFF
Majestic = M	58	A.D. ON
	48	A.D. OFF
Jones = J		

FIGURE I

PULP REFINABLITY
ASPHALT DISPERSION ON VS. OFF

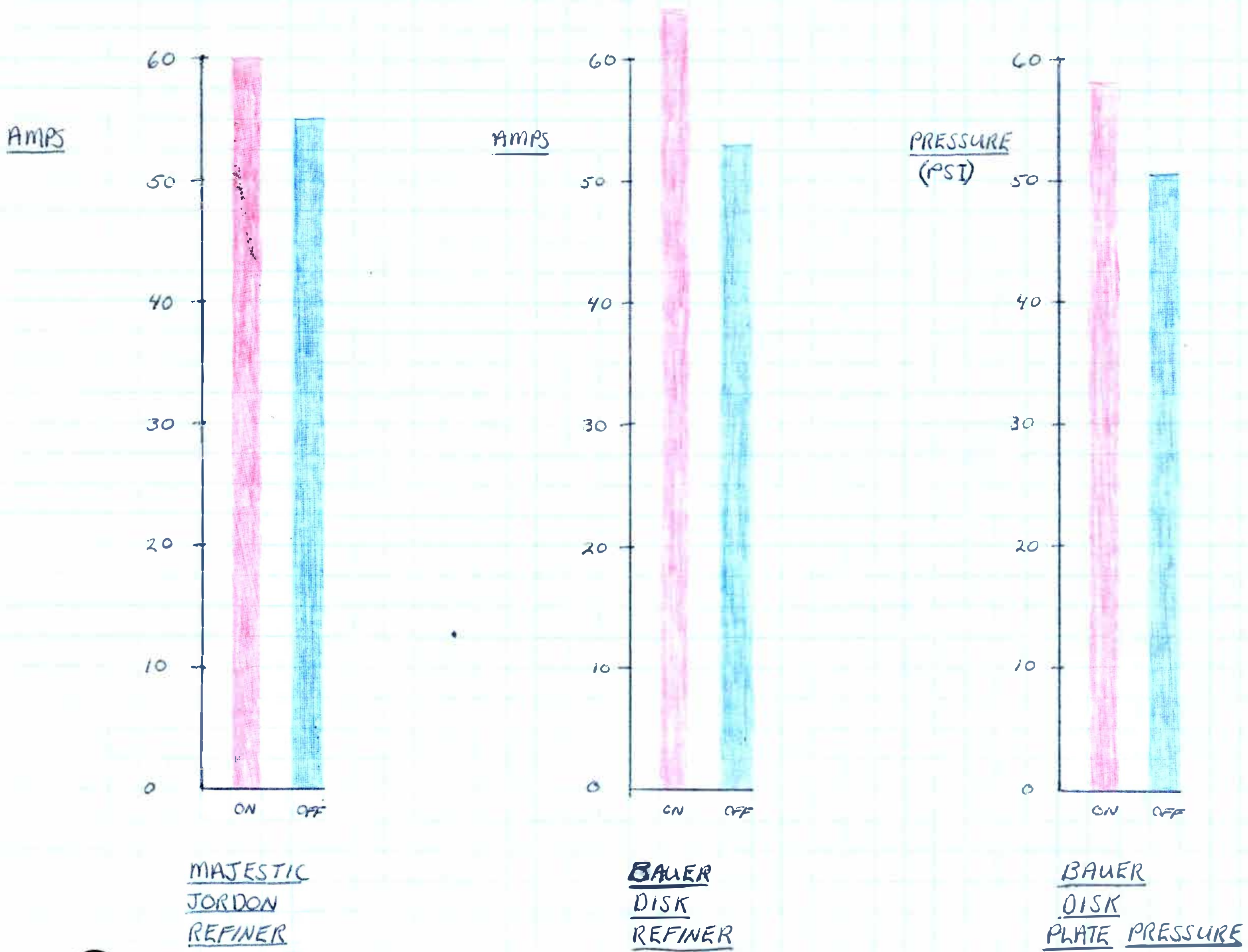


TABLE II

Production

DATE	LBS/HR	A.D.	DATE	LBS/HR	A.D.
12-11	19,269	ON	2-8	20,800	OFF
12-12	20,412	OFF	2-9	21,400	OFF
12-13	18,749	OFF	2-10	21,400	OFF
12-14	18,700	OFF	2-11	20,600	OFF
12-15	20,400	ON	2-14	21,200	OFF
12-16	20,300	ON	2-15	20,900	OFF
12-17	30,000	ON	2-17	20,900	OFF
12-18	19,800	ON	2-18	19,100	OFF
1-1	20,100	ON	2-21	21,000	OFF
1-3	20,200	ON	2-22	20,100	OFF
1-4	19,500	OFF	2-23	19,400	OFF
1-5	20,500	OFF	2-24	19,900	OFF
1-7	19,700	OFF	2-25	19,300	OFF
1-12	19,600	OFF	2-28	19,000	ON
1-13	20,100	OFF	2-29	19,700	OFF
1-14	20,400	OFF			
1-15	-	OFF	3-12	19,100	ON
1-16	-	OFF	3-13	19,800	ON
1-17	20,100	OFF	3-14	18,600	ON
1-18	19,100	OFF	3-15	18,700	ON
1-19	19,800	OFF	3-16	18,800	ON
1-20	19,400	OFF	3-19	19,500	ON
1-21	17,900	OFF	3-20	19,900	ON
1-24	19,700	OFF	3-21	18,400	ON
1-25	19,400	OFF	3-22	17,600	ON
1-26	20,400	OFF	3-23	20,000	ON
1-27	20,800	OFF			
2-2	19,700	OFF			
2-5	19,900	OFF			
2-7	20,700	OFF			

A.D. ON 19,483 LBS/HR AVERAGE

A.D. OFF 19,998 LBS/HR AVERAGE

FIGURE II

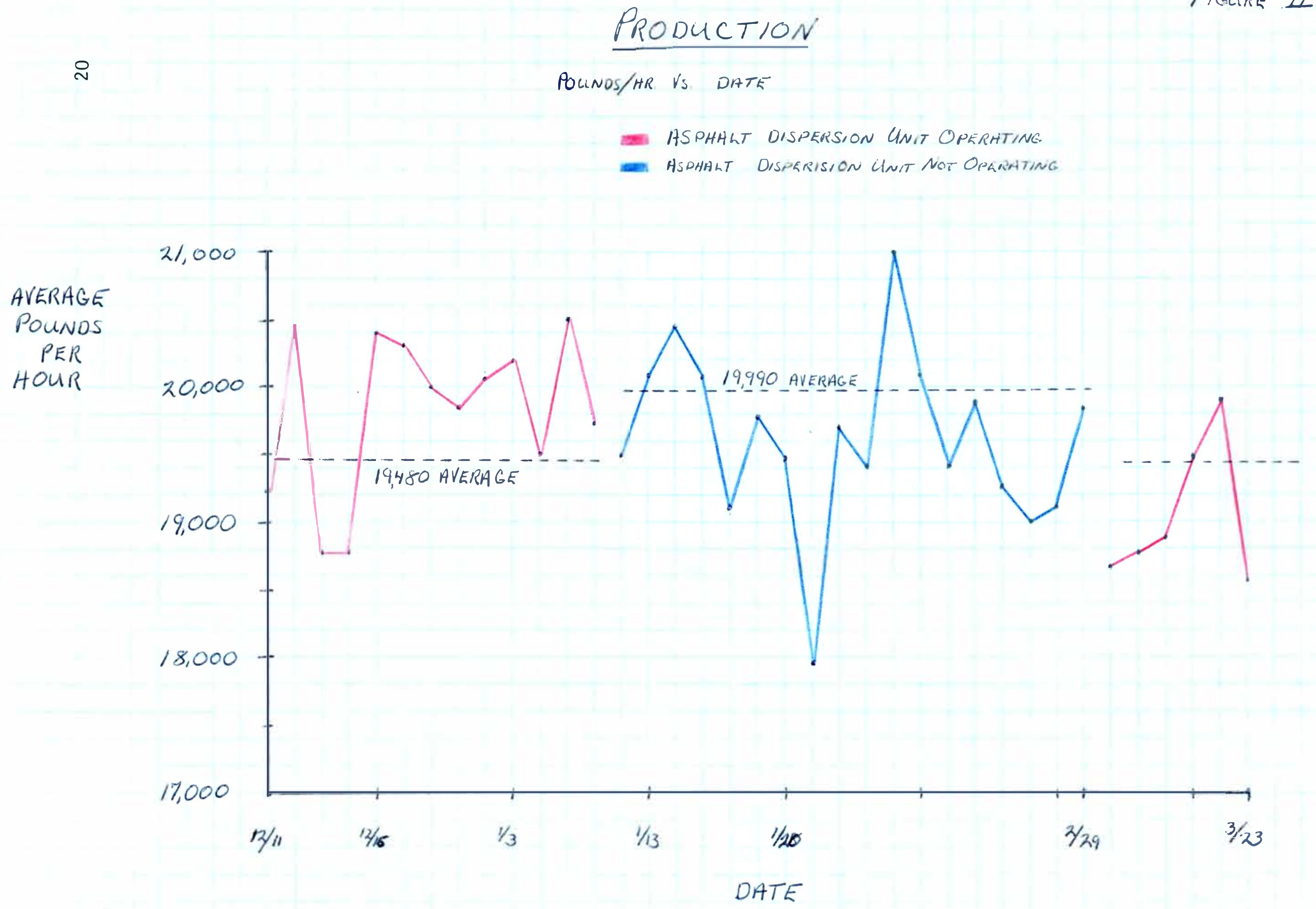

PRODUCTION
POUNDS/HR VS. DATE
ASPHALT DISPERSION UNIT OPERATING
ASPHALT DISPERISION UNIT NOT OPERATING
AVERAGE POUNDS PER HOUR
21,000
20,000
19,000
18,000
17,000
19,480 AVERAGE
19,990 AVERAGE
12/11
12/16
1/3
1/13
1/20
2/29
3/23
DATE

TABLE III

Temperature

	A.D. ON	A.D. OFF
Hydrapulper	87-107 Ave 99°F	87-106 Ave 99.3°F
Sidehill	90-108 Ave 99.7°F	85-105 Ave 99.2°F
Machine Chest	120-135 Ave 128°F	88-109 Ave 99.8°F
Vats 2	102-114 Ave 110°F	84-100 Ave 90.7°F
5	105-118 Ave 114°F	84-103 Ave 92.6°F
8	90-116 Ave 104°F	84-104 Ave 91°F

FIGURE III

TEMPERATURES: SYSTEM CHANGES

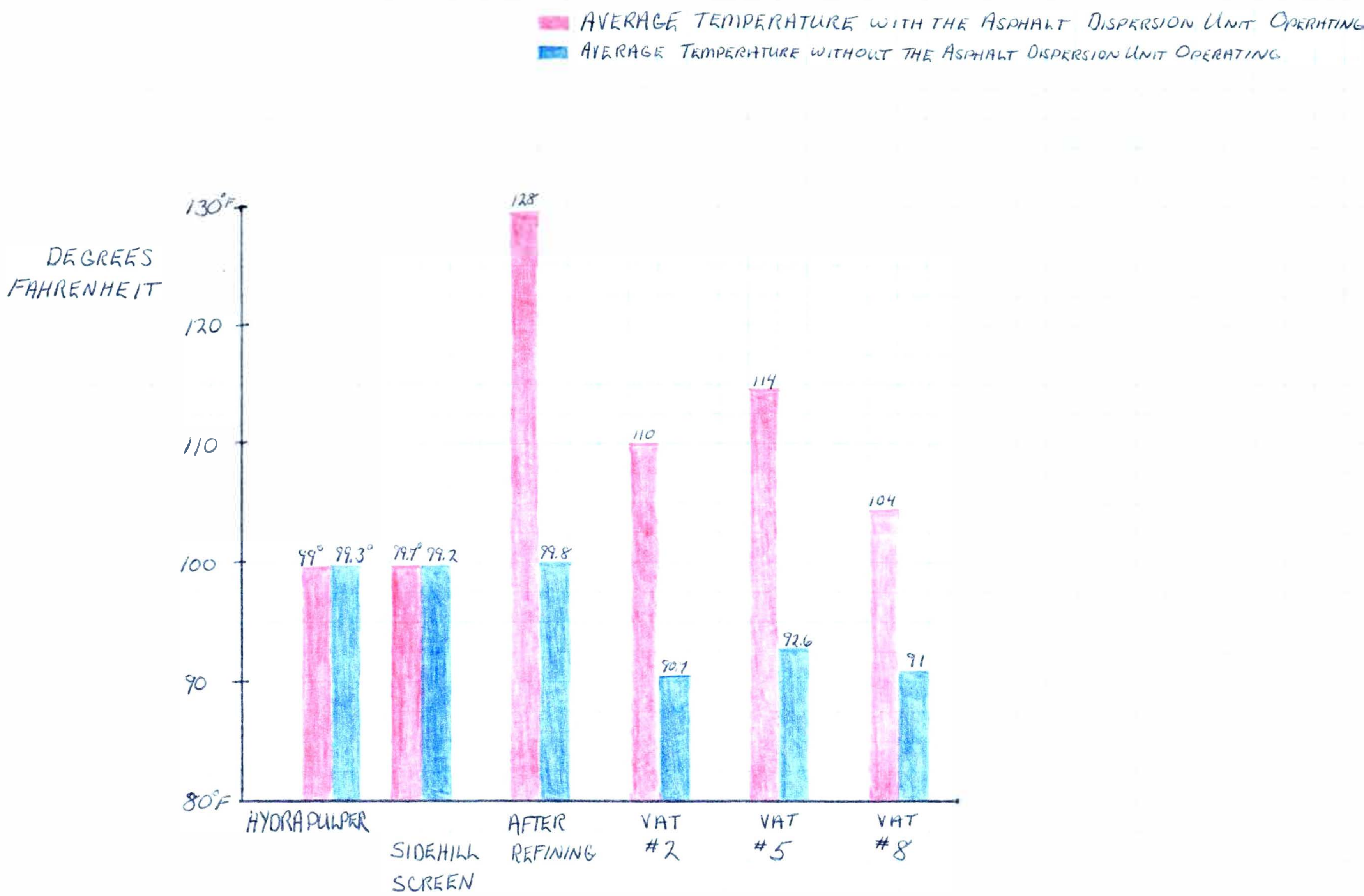


TABLE IV

Ply Bonds

CALIPER	A.D. ON	A.D. OFF	DIFFERENCE
.235	124	129	-5
.024	110	134	-24
.025	132	134	-2
.027	128	133	05
.0285	134	127	+7
.0295	124	131	-7
.030	136	138	-2
.031	138	128	+10
.032	131	134	-3
.033	120	137	-17
.034	135	146	-11

Generally ply bonds are greater when the A. D. is off. Average 5.36 lbs. higher.

TABLE V

Density

DATE	DEN	MOIST	DATE	DEN	MOIST
11-28	3.25	3.7 ON	1-24	3.32	4.0 OFF
11-29	3.27	4.0 ON	1-25	3.31	3.9 OFF
11-30	3.32	4.0 ON	1-26	3.40	4.1 OFF
12-1	3.44	4.3 ON	1-27	3.33	3.7 OFF
12-2	3.39	4.3 ON	1-28	3.35	4.1 OFF
12-3	3.29	4.5 ON	2-1	3.41	4.7 OFF
12-6	3.25	3.9 ON	2-2	3.31	4.1 OFF
12-7	3.26	4.5 ON	2-3	3.32	4.0 OFF
12-8	3.35	4.7 ON	2-4	3.35	4.1 OFF
12-9	3.32	4.6 ON	2-7	3.36	4.3 OFF
12-10	3.30	4.2 ON	2-8	3.33	4.2 OFF
12-13	3.24	4.1 ON	2-9	3.40	4.4 OFF
12-14	3.32	4.1 ON	2-10	3.43	4.3 OFF
12-15	3.34	4.7 ON	2-11	3.34	4.5 OFF
12-16	3.35	4.4 OFF	2-14	3.41	4.1 OFF
12-17	3.39	4.3 OFF	2-15	3.30	4.1 OFF
12-20	3.38	4.3 OFF	2-18	3.46	4.5 OFF
12-21	3.30	4.1 ON	2-21	3.30	4.3 OFF
12-22	3.35	4.3 ON	2-22	3.46	4.6 OFF
12-23	3.35	4.1 ON	2-23	3.41	4.4 OFF
12-29	3.26	4.1 ON	2-24	3.36	4.4 OFF
12-30	3.27	4.0 ON	2-25	3.39	4.3 OFF
1-4	3.32	4.4 OFF	2-28	3.33	4.2 ON
1-5	3.26	4.1 ON	2-29	3.40	4.4 OFF
1-6	3.35	4.0 ON	2-30	3.34	4.1 OFF
1-7	3.27	4.5 ON	3-1	3.31	4.3 OFF
1-10	3.35	4.4 ON	3-12	3.32	4.0 ON
1-11	3.43	4.6 OFF	3-13	3.37	ON
1-12	3.36	4.2 OFF	3-14	3.33	ON
1-13	3.39	4.4 OFF	3-15	3.36	4.4 ON
1-14	3.47	4.5 OFF	3-16	3.34	4.4 ON
1-17	3.37	4.6 OFF	3-19	3.31	4.4 ON
1-18	3.39	4.0 OFF	3-20	3.24	ON
1-19	3.35	4.0 OFF	3-21	3.34	4.2 ON
1-20	3.35	3.7 OFF	3-22	3.33	4.4 ON
1-21	3.35	4.0 OFF	3-23	3.30	4.2 ON

	A.D. ON	A.D. OFF
DENSITY	3.31	3.37

FIGURE IV

DENSITY

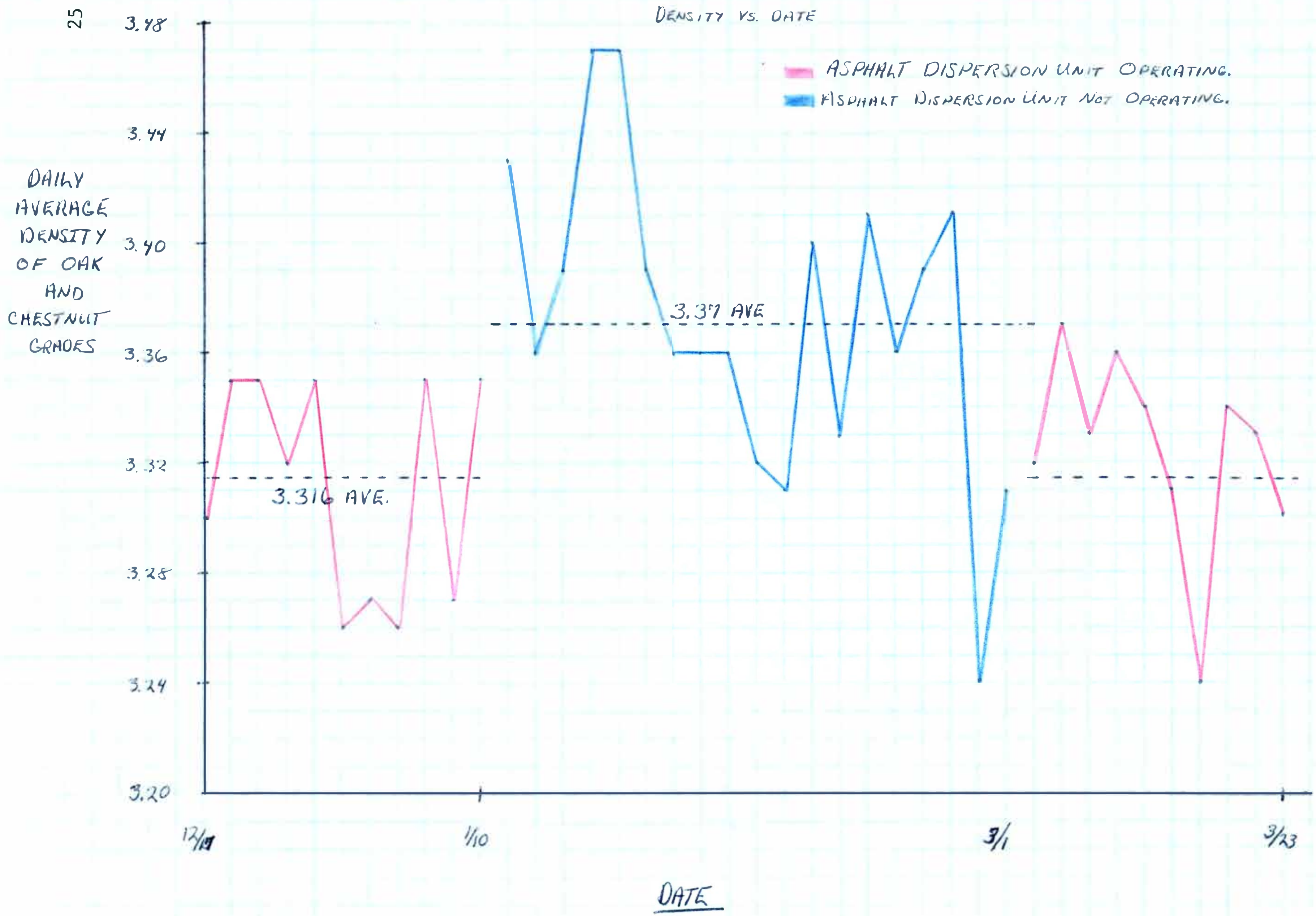


FIGURE V

BOARD MACHINE
DENSITY

BY CALIPER VS. MONTHLY AVERAGE

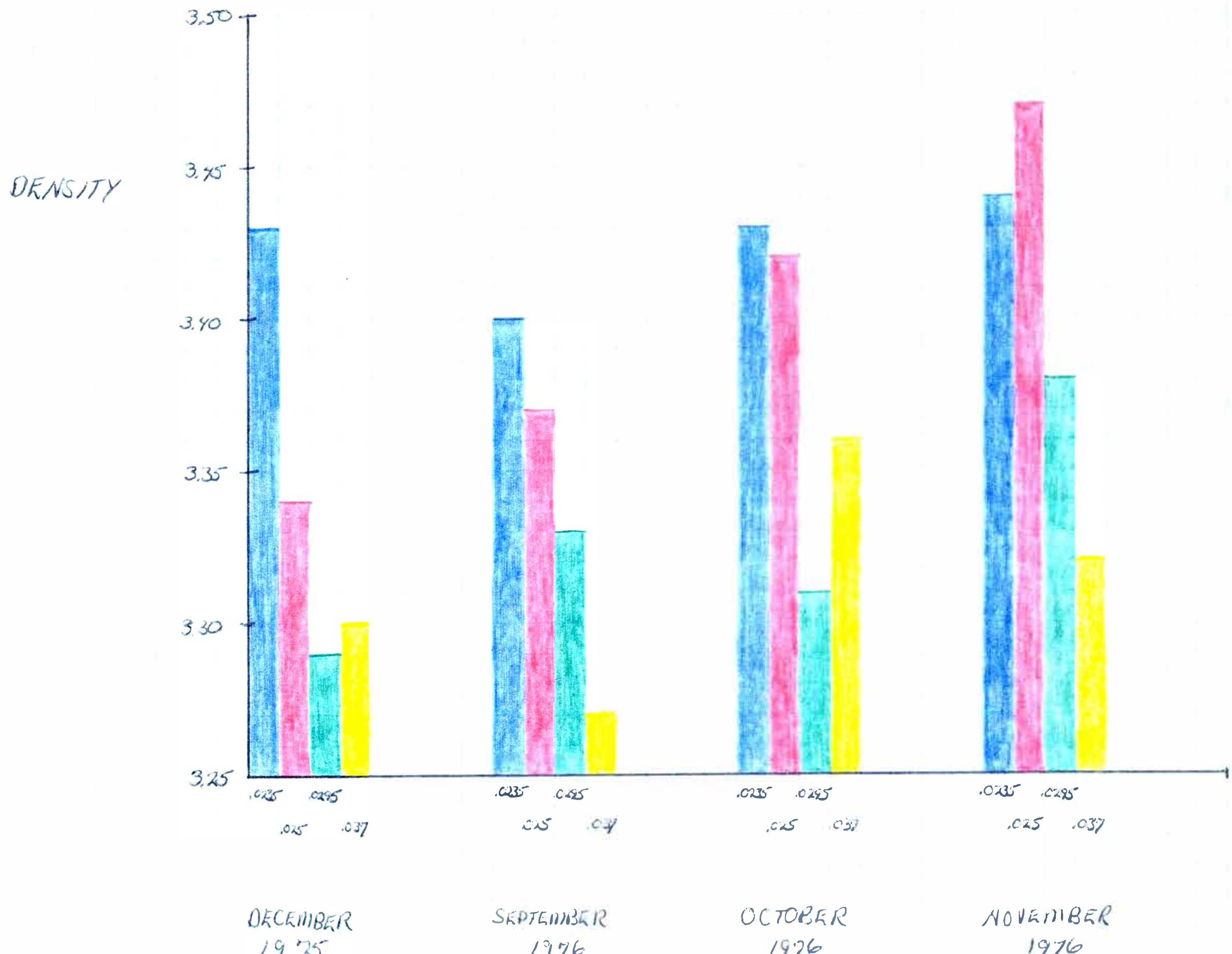


TABLE VI

Power

DATE	STEAM	BTU/TON		DATE	STEAM	BTU/TON	
11-26	101,875	14.6	ON	1-20	82,875	12.7	OFF
11-29	103,562	21.1	ON	1-24	84,562	13.0	OFF
11-30	102,875	13.99	ON	1-25	87,812	13.79	OFF
12-1	94,750	19.6	ON	1-26	83,812	12.0	OFF
12-2	91,250	16.9	ON	1-27	85,062	11.10	OFF
12-3	95,875	15.5	ON	1-28	84,000	11.96	OFF
12-6	102,625	14.1	ON	2-1	87,375	13.26	OFF
12-7	99,687	13.8	ON	2-2	92,375	15.94	OFF
12-8	97,187	16.2	ON	2-3	91,062	14.18	OFF
12-9	92,250	15.6	ON	2-5	80,312		OFF
12-10	100,125	16.6	ON	2-7	84,250	13.52	OFF
12-11	100,750	13.98	ON	2-8	89,438	12.19	OFF
12-13	100,437	14.0	ON	2-9	91,562	14.35	OFF
12-14	98,312	15.04	OFF	2-10	88,687	16.39	OFF
12-15	93,562	14.1	OFF	2-11	85,937	12.36	OFF
12-16	90,326	15.2	OFF	2-14	87,937	12.6	OFF
12-17	100,562	14.4	ON	2-15	85,625	12.67	OFF
12-26	103,437	13.1	ON	2-18	83,052	13.47	OFF
12-28	102,562	13.47	ON	2-21	82,187	12.99	OFF
12-29	99,312	15.5	ON	2-22	84,750	12.42	OFF
12-30	99,000	13.0	ON	2-23	85,000	12.0	OFF
1-4	93,954	14.0	OFF	2-24	83,875	11.92	OFF
1-5	105,187	12.92	ON	2-25	81,687	12.56	OFF
1-6	98,250	17.1	ON	2-28	87,625	13.22	OFF
1-7	96,391	16.1	ON	2-29	78,562	27.91	OFF
1-10	94,188	17.4	ON	2-30	84,875	13.98	OFF
1-11	89,933	16.9	OFF				
1-12	92,250	12.2	OFF	3-13	93,187	13.4	ON
1-13	79,500	11.75	OFF	3-14	92,125	13.66	ON
1-14	83,687	12.87	OFF	3-15	93,687	14.5	ON
1-17	92,375	16.38	OFF	3-16	87,312	13.6	ON
1-18	85,625	12.59	OFF	3-19	87,875	18.86	ON
1-19	87,375	12.0	OFF	3-20	90,562	13.67	ON
				3-21	93,312	13.92	ON
				3-22	90,062	51.46	ON
				3-23	90,562	15.79	ON

	STEAM	BTU/TON
A.D. ON	97,262	15.2
AVERAGE A.D. OFF	86,796	13.4

FIGURE VI

STEAM CONSUMPTION

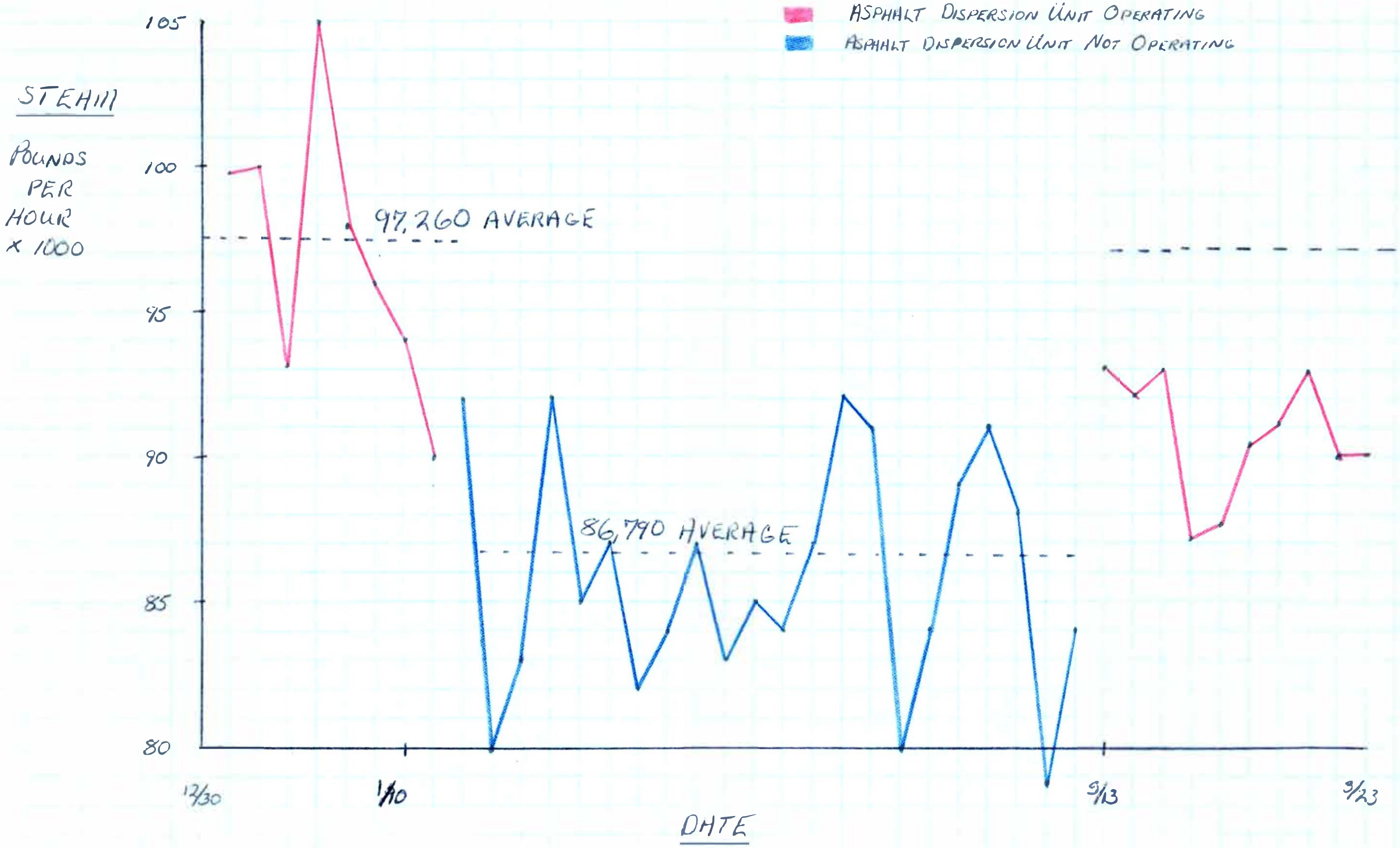


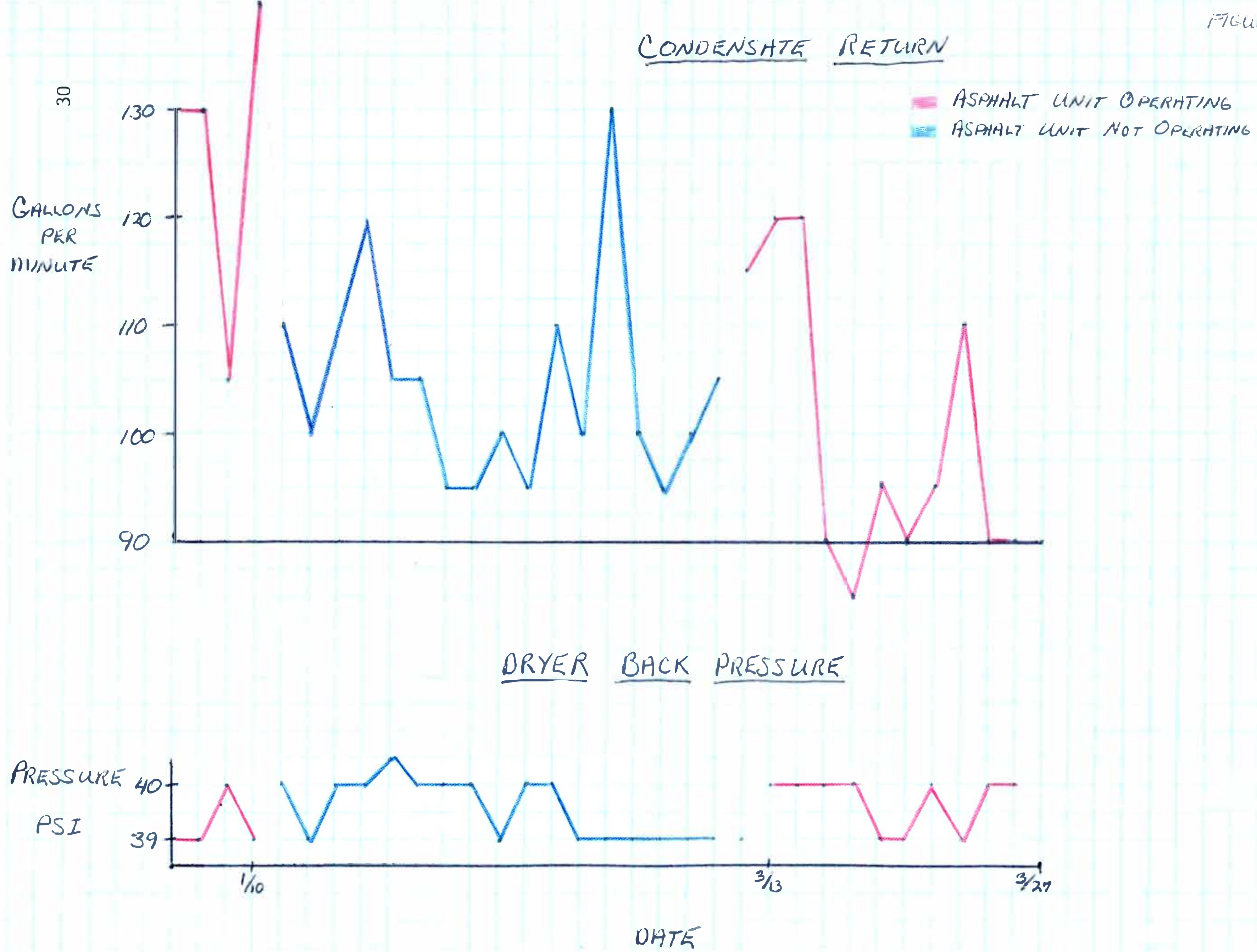
TABLE VII

Dryer Back Press & Condensate Return Daily Average

DATE	DBP	CR
1-5	39 PSI	130 GPM ON
1-6	39	130 ON
1-7	20	105 ON
1-10	39	140 ON
1-12	40	110 OFF
1-13	39	103 OFF
1-14	40	100 OFF
1-17	40	110 OFF
1-18	40.5	120 OFF
1-19	40	105 OFF
1-20	40	95 OFF
1-21	40	95 OFF
1-24	39	100 OFF
1-25	40	95 OFF
1-26	40	110 OFF
1-27	39	100 OFF
1-28	39	130 OFF
2-1	39	100 OFF
2-2	39	100 OFF
2-4	39	95 OFF
2-8	39	100 OFF
2-10	39	105 OFF
3-13	40	115 ON
3-14	40	120 ON
3-15	40	120 ON
3-16	40	90 ON
3-19	39	85 ON
3-20	39	95 ON
3-21	40	90 ON
3-22	39	95 ON
3-23	40	110 ON
3-27	40	90 ON

	ON	OFF
Dryer Back Press	40 PSI	40 PSI
Condensate Return	108 PSI	104 PSI

FIGURE VII


CONDENSATE RETURN
ASPHALT UNIT OPERATING
ASPHALT UNIT NOT OPERATING
GALLONS PER MINUTE
130
120
110
100
90
DRYER BACK PRESSURE
PRESSURE PSI
40
39
1/10
3/13
3/27
DATE

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